System Also Tracks Animals

The Argos System

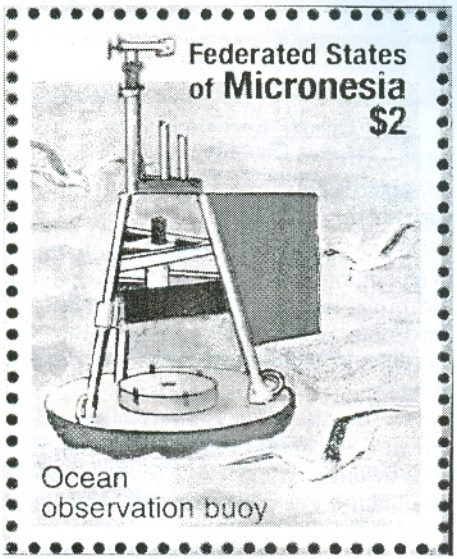
Don Hillger and Garry Toth

Argos is a satellite-based system which collects, processes, and disseminates worldwide environmental data from fixed and mobile platforms. It also has the ability to geographically locate the source of the data anywhere on the earth using the Doppler effect. Since 1978, *Argos* has provided data to environmental research and protection communities that in many cases would otherwise have been unobtainable. The *Argos* system is also important in meteorology because many remote automatic weather stations report to central locations via *Argos*.

Argos was developed under an agreement between the *Centre National d'Etudes Spatiales* (*CNES*), the *National Aeronautics and Space Administration* (*NASA*), and the *National Oceanic and Atmospheric Administration* (*NOAA*). The system utilizes both ground and satellite-based resources to accomplish its mission. This includes the instruments carried aboard the *NOAA* polar-orbiting environmental satellites (*POES*), receiving stations around the world, and major processing facilities in France and the United States.

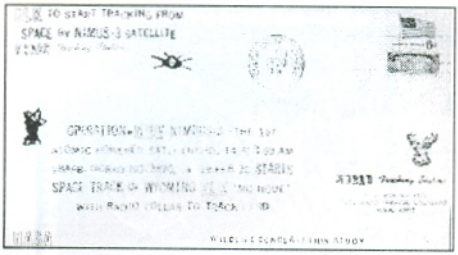
Argos is not an acronym; rather it is the chosen name for the system. For further information on the *Argos* system, see <*http://noaasis.noaa.gov/ARGOS/*>. Unlike the *Search and Rescue Satellite Aided Tracking* (*SARSAT*) system designed specifically for the rescue of persons in distress (Hillger and Toth, *Topical Time*, May/June, 2007), the *Argos* system is intended for environmental data collection and limited other use. However, many of the *Argos* system characteristics are similar to those of *SARSAT*. For example, in both systems global coverage is provided via the *NOAA* satellites that serve as orbiting platforms that collect the data and then transfer the information to ground stations.

The earliest known philatelic reference to *Argos* is found on a 1978 launch cover for *TIROS-N*, the first satellite to carry the system. The *Argos* name is not mentioned but the cachet on the cover notes a "Data Collection System" as one of the sensors on this satellite; this was the first of a new generation of *NOAA* satellites. *Argos* has been carried on all *NOAA* satellites from that time forward.



***Argos* Collects Data From Ocean Buoys**
Micronesia (*Scott* 297)

Micronesia issued a souvenir sheet (1998/*Scott* 297) showing an ocean observation buoy in connection with the El Niño warm water zone in the equatorial Pacific Ocean. The souvenir sheet notes that 70 buoys are moored in that region for monitoring ocean temperatures and that the data from the buoys are transmitted via satellite to land-based research facilities. *Argos* is not directly mentioned, but it is known that *Argos* is the system used for collecting the data from these buoys.



Cover Confirms *Nimbus-3* Tracked Elk Wearing Transmitter In Wyoming

Tracking Animals

Before *Argos* was formally established, two other tracking systems were tested on the *Nebulus* series of polar-orbiting satillites. One of the important applications of these systems was animal tracking. The first animal ever tracked via satellite was an elk wearing an 11 kilogram transmitter pack. This was conducted by *Nimbus-3* that was launched in 1969. Brothers **Frank Craighead Jr.** and **John Craighead** were part of the team in this *NASA*, Smithsonian Institution, and National Geographic Society experiment. The tracking took place in the National Elk Refuge near Jackson, Wyoming. The above postal cover from this study indicates the name "Monique" for the elk that was tracked. The name "Operation MOE" on the cover may have been an acronym for "Movement of Elk."

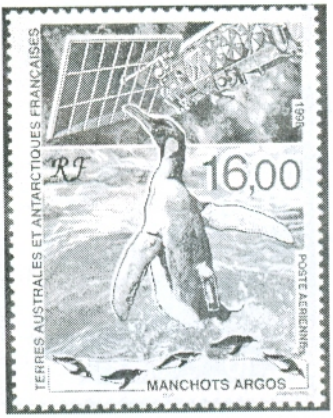
Another pre-*Argos* system was carried on *Nimbus-6*, launched in 1974, primarily for tracking and receiving data from high-altitude meteorological balloons. But the system was also used to track two polar bears, a loggerhead turtle, and two wild Hawaiian spotted dolphins. No postal covers have been found for this system.

Polar Bear In Circle May Have Transmitter FSAT (*Scott* C50)

Albatrosses Are Tracked Over The Austral Ocean FSAT (*Scott* C114)

The first of several stamps of the French Southern and Antarctic Territories (FSAT) (1992/*Scott* C50) includes several icons in small circles on the stamp. One of these circles shows a polar bear, possibly wearing a harness and radio transmitter. That appears to be an indication of the use of *Argos*, although there are no polar bears in the Antarctic. However other organizations have carried out Arctic polar bear research using the *Argos* system. For example, between 1985 and 2005, American and Canadian researchers used satellite telemetry and the *Argos* system to track a large number of female polar bears in northern Alaska, the western Canadian Arctic, and the southern Arctic Ocean. The purpose was to determine the changes in distribution of maternal dens for the polar bears.

Another FSAT stamp (1991/*Scott* C114) shows several albatrosses. The tracking of many types of Antarctic marine wildlife is made possible by miniature *Argos* transmitters, often with enhanced location information through the use of Global Position System (*GPS*) satellite. Albatrosses have been tracked over the Austral Ocean and researchers have determined that these birds, moving with the strong winds of that area, can travel at speeds of up to 135 kilometers per hour. They fly an average of 300 kilometers per day, but are capable of covering enormous distances (up to 2,000 kilometers) when foraging to feed their fledglings. Some albatrosses have been tracked over a period of several months, traveling



Penguin Has Small *Argos* Transmitter On Its Back FSAT (*Scott* C147)

30,000 kilometers or more, and even moving completely around the earth in the southern latitudes.

A third FSAT stamp (1998/*Scott* C147) shows a penguin with a small *Argos* transmitter attached to its back. The emperor penguin tracking program has allowed researchers to unravel some of the mystery as to how these animals survive the intense cold over long periods without food. By huddling together to maintain body temperature, penguins minimize their energy outlay at locations that may be as much as 200 kilometers from their food source in the open sea. *Argos* helped determine that the emperors periodically march to the Antarctic coast where they dive for food in open water in ice-free areas. The birds have also been tracked on foraging expeditions out to sea, with round trip distances of up to 1,500 kilometers.

The last stamp pictured that mentions *Argos* was issued by the Malagasy Republic (1990/*Scott* 969). It shows elephants, and the text on the stamp notes a tracking program for elephants in Namibia. The authors were unable to unearth details of the Namibian elephant tracking, but it is known that other elephants have been tracked using *Argos* in Malaysia, Thailand, and Sri Lanka. Satellite telemetry made it possible to follow them over an area of some 7,000 square kilometers. Such a large range precludes ground tracking, and tracking by aircraft would have been prohibitively expensive.

***Argos* Conducted Tracking Program For Elephants Malagasy (*Scott* 969)**

One of the Sri Lankan elephants found its way back to civilization after being transported 75 kilometers away from a garbage dump where it had become a pest. This was discovered by tracking that elephant using a combination of *GPS* and *Argos*. Such translocation of elephants from areas of conflict with humans into protected areas is a mainstay of elephant management in Asia.

In addition to observing the oceans and tracking animals, these systems can be used for monitoring public health, managing fisheries, and enforcing marine security, as well as tracking adventurers, yachts on oceanic races, and hazardous materials.

Subsequent Generations

Argos has continued to evolve into its second and third generations. *Argos-2*, first available on the *NOAA-15* polar-orbiting satellite launched in 1998, has improved receiver sensitivity for use with lower powered and even smaller transmitters, along with the receiving capability for more simultaneous uplinks. The Japanese satellite *ADEOS-2* also carried the newer *Argos-2* system. *Argos-3* was launched on the first European *Meteosat* polar-orbiting satellite. This improved system has two-way communication capability, so that it can return signals to the surface-based transmitters, confirming receipt of their data.

Finally, a system complimentary to *Argos*, but carried on geostationary weather satellites, is the *Data Collection System* (*DCS*) carried on *GOES* and operated by *NOAA*. While no stamps are

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The Argos System

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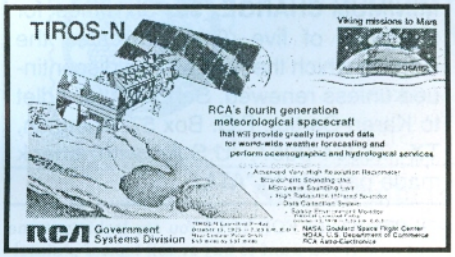

***TIROS-N* First Satellite To Carry *Argos* But Not Mentioned On This Cover**

known to feature this system, a number of satellite launch covers include indirect references to *DCS*. A *GOES-3* launch cover in particular mentions the ability to collect weather data from "up to 10,000 ground stations in six hours" (an image is available in the authors' *Argos* webpage). Data from the *DCS* are available more frequently and quickly than with the polar-orbiting systems since geostationary satellites are always in view of ground stations within the footprint of the satellite. Similar data collection systems are also carried on Japanese *GMS* and European *Meteosat* satellites, for which launch covers noting the system also exist.

For a checklist of postal items identified as showing *Argos* systems, see the authors' webpage at <*http://www.cira.colostate.edu/ramm/hillger/argos.htm*>.

The authors would be interested to learn of any postal items referring to *Argos* that have been missed.•

The authors have researched and written extensively on the subjects of weather and unmanned satellites on stamps and covers.

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